PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 27 July 2000 (27.07.00)	
International application No. PCT/IB99/01747	**Applicant's or agent's file reference** P14232 PCT
International filing date (day/month/year) 29 October 1999 (29.10.99)	**Priority date** (day/month/year) 29 October 1998 (29.10.98)
Applicant BRITS, Willem, Hendrik	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

26 May 2000 (26.05.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Pascal Piriou
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

IB9901747

P, ENT COOPERATION TREAT

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

JOHN & KERNICK
P.O. Box 3511
Halfway House 1685
AFRIQUE DU SUD

Date of mailing (day/month/year)
29 August 2000 (29.08.00)

Applicant's or agent's file reference
P14232 PCT

IMPORTANT NOTIFICATION

International application No.
PCT/IB99/01747

International filing date (day/month/year)
29 October 1999 (29.10.99)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [X] the agent [ ] the common representative

Name and Address

JOHN & KERNICK
Kernick House
Howick Close
Waterfall Park
1685 Midrand
South Africa

State of Nationality:
State of Residence:
Telephone No.: 2711-315-7400
Facsimile No.: 2711-315-7444
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address

JOHN & KERNICK
P.O. Box 3511
Halfway House 1685
South Africa

State of Nationality:
State of Residence:
Telephone No.: 2711-315-7400
Facsimile No.: 2711-315-7444
Teleprinter No.:

3. Further observations, if necessary:
Change in the address for postal deliveries.

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Aino Metcalfe
Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

003494119

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P 14505PC00		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IB99/01747	29/10/1999	29/10/1998
International Patent Classification (IPC) or national classification and IPC G01N33/20		
Applicant BRITS, Willem, Hendrik et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26/05/2000	12.04.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rumbo, A Telephone No. +49 89 2399 8407

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01747

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-26 as originally filed

Claims, No.:

1-37 as received on 07/03/2001 with letter of 07/03/2001

Drawings, sheets:

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

☐ restricted the claims.

☒ paid additional fees.

☐ paid additional fees under protest.

☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☒ not complied with for the following reasons:
see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-37
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-37

Industrial applicability (IA)	Yes:	Claims	1-37
	No:	Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

SECTION IV: UNITY

The claimed subject-matter does not comply with the requirement of unity of invention (Rules 13.1, 13.2 and 13.3 PCT).

The terms **"for use in a method for assaying an ore sample according to"** within the wording of claims 16-23 (device) and claims 26-37 (product) **do not constitute "special technical features"** in the sense of Rule 13.2 PCT (see in particular lines 4-6 of Rule 13.2 PCT) since they merely indicate that the device or product can be used for a particular purpose (not exlcuding any othe method or use). **The cited terms cannot, therefore, be considered as the basis for a single general inventive concept.**

The following groups of inventions are present in the international application:

1. first group: claims 1-15 (method for assaying ores containing the steps cited).
2. second group: claims 16-23 (receptacle).
3. third group: claims 24-25 (method for separating molten lead from slag)
4. fourth group: claims 26-30 (flux composition).
5. fifth group: claims 31-37 (a sealed container).

SECTION V:

The subject-matter of the first to fifth groups of inventions does not meet the novelty requirements of Article 33(2) PCT:

V.1 In this regard the attention of the applicant is drawn to the fact that terms like "for assaying an ore sample to determine the concentration of selected metals therein" in the wording of claim 1 does not add to the claimed process any step different from those explicitly cited in the claim namely combining ore and flux, heating (inductively) to fusion of slag and lead and separating lead from slag.

D1=US-A-5 849 649 discloses (see col. 1, line 18 and col. 2, lines 41-49 as well as col. 5, lines 31-35) a glass flux composition containing aluminium oxides, magnesium oxides, zirconium oxide and other oxides of metals, which can be considered ores since they also naturally occur as minerals, and lead oxide mixed together. This is a glass flux composition to be used as enamel for application to ceramic ware. **Induction ovens being the most used type of ov n for glass production** and slags always separating from molten metals at the oven exit, it is therefore straightforward that a process such as that defined in D1 is prejudicial for the novelty of process claims 1 to15.

V.2 The terms " for use in fire assaying of ore samples" in the wording of claim 26 do not add to the claimed product anything over the composition explicitly disclosed. Nothing apart from the explicitly cited chemical compounds cited (namely sodium hydroxide) is present in the wording of the claimed product. Without citing any document, it is evident that claims 26 and 27 are not novel since it is evident that compositions containing exclusively sodium hydroxide or sodium hydroxide aqueous solutions containing amounts ranging from 20-60% by weight were known before the filing date of the present application.
In the absence of at least one differentiating technical feature present in the wording of the product independent claim, the novelty of the product claims 26 to 30 cannot be acknowledged.

V.3 The disclosure of document D2= WO-A-96/41161 (see figure 1) clearly concerns a receptacle with a collecting cavity (40,42) and a spout(18). Of course the walls of the collecting cavity act as a barrier between the collecting cavity and the opening of the receptacle. The cited document is prejudicial for the novelty of at least claims 16 to 25.
In the same way D3=GB-A-2 289 758 (see figure 3, items 18,22,20 and page 3, line 10-page 4, line 8) is also prejudicial for the novelty of at least claims 16 to 25.
V.4 The disclosure of D4=US-A-3 751 965 (see figures 1 to 3, in particular items 2, 5a and 1 as well as corresponding parts of the description) is prejudicial for the novelty of claims 31-37.

V.5 INVENTIVE STEP
None of the technical features of the dependent claims of all the groups of inventions (see use of carbon based plastic container identified by a bar code of claims 6 to 8 and its identification via a scanner of claims 14-15; graphite or zirconium melting pots of claims 10-11) **nor any other technical feature disclosed in the description** seems to solve a technical problem which could not have been solved by the normal procedures of the prior art. On the contrary they seem to concern merely well known features therefrom and therefore cannot be considered inventive.

In the absence of at least one differentiating technical feature present in the wording of the process and product claims, which is responsible for the solution of a technical problem which could not have been solved by the technical features of the prior art (D1 to D4), the inventive step of the claimed subject matter according to Article 33(3) PCT cannot be acknowledged since differentiating technical features not solving a technical problem can be considered as obvious modifications of the prior art.

SECTION VIII:

The presence of two independent process (method) claims each of them concerning completely different technical features (claim 1 concerns the addition of a flux composition containing any amount of lead whereas claim 24 concerns the separation of a slag using a receptacle with a cavity and a product claim 26 concerning flux compositions comprising exclusively sodium hydroxide and two device claims (claim 16 concerns a receptacle with collecting cavity and claim 31 concerns a sealed container) does not allow third parties to know which of the technical features are essential for the invention to be performed and which other are merely optional features. Therefore, the claimed subject-matter of claims 1, 24 and 26 and that of claims 16 and 31 are in breach with the clarity requirements of Article 6 PCT.

All the independent process, product and device claims should concern exactly the same technical features. Failure to meet that request the clarity of the claimed subject-matter cannot be acknowledged (Article 6 PCT).

CLAIMS

1. A method for assaying an ore sample to determine the concentration of selected metals therein, comprising the steps of:

combining the prepared ore sample with a lead-containing flux in a receptacle;

inductively heating the combination to form a fusion of slag and lead containing the metals in the sample; and

separating the lead from the slag.

2. The method according to claim 1 wherein the combination is heated at a predetermined temperature profile.

3. The method according to claim 2 wherein the predetermined reference temperature profile is determined by the characteristics and amount of the ore sample and/or the flux.

4. The method according to claim 3 wherein the sample is supplied with a high level of heat for a predetermined first period of time and then supplied with a lower level of heat for a predetermined second period of time to form the fusion of slag and lead.

5. The method according to any one of the preceding claims wherein the sample of ore and flux are combined in a container made from carbon-based material, and the container, the sample and the flux are inductively heated.

6. The method according to claim 5 wherein the container is made from plastics material and comprises a lid which is arranged to close the container sealingly.

7. The method according to claim 5 or 6 wherein the container includes identification means for identifying the sample contained therein.

8. The method according to claim 7 wherein the identification means is a barcode.

9. A method according to any one of the preceding claims wherein the flux contains sodium hydroxide.

10. The method according to any one of the preceding claims wherein the sample is heated inductively within a graphite melting pot [receptacle] in an induction furnace.

11. The method according to any one of the preceding claims wherein the sample is heated inductively within a zirconium melting pot [receptacle] in an induction furnace.

12. The method according to any one of the preceding claims wherein molten lead separated from the slag is poured into a chilled mould, to provide a solid lead button.

13. A method according to claim 5 including the steps of storing information on each sample on a central database, providing each container into which the sample is poured with a unique identification means,

identifying each container before inserting it into the induction furnace, correlating the identity of the container and information on the central database, and applying a predetermined reference temperature profile to the sample, according to the information on the sample stored in the database.

14. A method according to claim 13 wherein the identification means is a bar code and the bar code is identified with a scanner.

15. A method according to any one of the preceding claims wherein each solid lead button is stamped with an identification code.

16. A receptacle for use in a method for assaying an ore sample according to claim 1, the receptacle comprising a base with a side wall extending from the base, the side wall defining a top opening into the receptacle, and the side wall having a collecting cavity, wherein the collecting cavity is sized to collect a predetermined amount of molten lead.

17. A receptacle for use in a method for assaying an ore sample according to claim 16 wherein the collecting cavity is located proximate the top opening of the receptacle.

18. A receptacle for use in a method for assaying an ore sample according to claim 16 or 17 wherein barrier means is provided between the collecting cavity and the opening of the receptacle, to trap molten lead in the collecting cavity.

19. A receptacle for use in a method for assaying an ore sample according to

any one of claims 16 to 18 wherein the collecting cavity is formed within a removable plug which is attachable to the side wall of the receptacle.

20. A receptacle for use in a method for assaying an ore sample according to any one of claims 16 to 19 including a first spout located at the top opening, above the collecting cavity.

21. A receptacle for use in a method for assaying an ore sample according to claim 20 including a second spout located at the top opening, diametrically opposed to the first spout.

22. A receptacle for use in a method for assaying an ore sample according to any one of claims 16 to 21 wherein the receptacle is also a melting pot for an induction furnace.

23. A receptacle for use in a method for assaying an ore sample according to any one of claims 16 to 22 made from graphite.

24. A method for separating molten lead from slag, in the receptacle of claim 16, the method including the steps of:

1. introducing a slag with a predetermined amount of molten lead therein into the receptacle;

2. rotating the receptacle in a first direction toward the collecting cavity so that the molten lead fills and is retained within the cavity, rotating the receptacle further so that the slag is discharged from the pening to the receptacle;

3. rotating the receptacle so that the molten lead flows out of the opening to the receptacle; and
4. collecting the lead discharged from the opening of the receptacle.

25. A method according to claim 24 wherein the receptacle is a melting pot surrounded by an electromagnetic coil and the electromagnetic coil is rotated together with the melting pot.

---

26. A flux composition for use in a method for assaying an ore sample according to claim 1, the flux composition containing sodium hydroxide.

27. A flux composition for use in a method for assaying an ore sample according to claim 26, comprising 20% to 60%, by weight, sodium hydroxide.

28. A flux composition for a method for assaying an ore sample according to any one of claims 26 to 27 further comprising:

20% to 60%, by weight, lead oxide; and
20% to 60%, by weight, borax.

29. A flux composition for use in a method for assaying an ore sample according to claim 27 comprising 20% to 50%, by weight sodium hydroxide, 25% to 40% lead oxide and 25% to 40% borax.

30. A flux composition for use in a method for assaying an ore sample

according to any one of claims 26 to 29 further including silver nitrate.

31. A sealed container, for use in a method for assaying in an ore sample according to claim 5, the sealed container made from a carbon-based sodium carbonate.

32. A sealed container for use in a method for assaying an ore sample according to claim 31 including a replaceable lid.

33. A sealed container for use in a method for assaying an ore sample according to claim 31 or 32 made from a combustible material.

34. A sealed container for use in a method for assaying an ore sample according to claim 33 made from a plastics material.

35. A sealed container for use in a method for assaying an ore sample according to claim 34 made from a mixture of plastics material and a flux material.

36. A sealed container for use in a method for assaying an ore sample according to claim 35 wherein the flux material is calcium carbonate.

37. A [sealed container for use in a method for assaying an ore sample according to claim 36, the mixture including 60 to 80%, by weight, calcium carbonate.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
P 14232 PCT PJW/avdm		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IB 99/01747	29/10/1999	29/10/1998
Applicant		
BRITS, Willem, Hendrik et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [X] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 3

   [X] as suggested by the applicant.

   [ ] None of the figures.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 99/01747

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01N33/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 793 155 A (FLOOD ET AL.) 19 February 1974 (1974-02-19) abstract column 4, line 14 - line 49; figure 1	1-15
A	US 4 799 999 A (MEDVINSKY ET AL.) 24 January 1989 (1989-01-24) abstract column 3, line 20 -column 4, line 37; figure 3	1-15
A	US 4 238 450 A (BREDEWEG ET AL.) 9 December 1980 (1980-12-09) abstract column 2, line 29 -column 4, line 49; figure 2	1-15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 May 2000	02.06.00

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Kempf, G

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 289 758 A (NIPPON SUBLANCE PROBE ENGINEER) 29 November 1995 (1995-11-29) abstract page 3, paragraph 2 -page 4, paragraph 2; figures 1,2 ---	16-30
A	WO 96 41161 A (MOLTEN METAL TECH INC) 19 December 1996 (1996-12-19) abstract page 5, line 8 - line 9; figure 1 ---	16-30
A	GB 1 251 731 A (BALZERS) 27 October 1971 (1971-10-27) abstract page 1, line 10 - line 18 page 2, line 108 - line 116; figure 1 ---	31-37
A	US 3 751 965 A (KRAUS T) 14 August 1973 (1973-08-14) abstract column 2, line 30 - line 65; figure 1 -----	31-37

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 99/01747

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-15

   Method for assaying a sample

2. Claims: 16-30

   A receptacle for separatig molten lead from slag

3. Claims: 31-37

   A sealed container.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB 99/01747

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3793155 A	19-02-1974	US 3652427 A	28-03-1972
US 4799999 A	24-01-1989	AU 1294388 A	02-11-1988
		EP 0362203 A	11-04-1990
		ES 2007173 A	01-06-1989
		JP 3188371 A	16-08-1991
		WO 8807674 A	06-10-1988
		ZA 8802207 A	22-02-1989
US 4238450 A	09-12-1980	NONE	
GB 2289758 A	29-11-1995	CN 1126317 A	10-07-1996
		IT T0950339 A	24-11-1995
		KR 184720 B	15-05-1999
WO 9641161 A	19-12-1996	AU 5971196 A	30-12-1996
		ZA 9604419 A	09-12-1996
GB 1251731 A	27-10-1971	CH 486680 A	28-02-1970
		DE 1934935 A	22-10-1970
		FR 2027530 A	02-10-1970
		NL 6900828 A,B	04-05-1970
US 3751965 A	14-08-1973	AT 307373 B	15-04-1973
		CH 530003 A	31-10-1972
		DE 2050558 A	20-01-1972
		FR 2105800 A	28-04-1972
		GB 1318127 A	23-05-1973
		NL 7012998 A	18-01-1972

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G01N 33/20 — A2

(11) International Publication Number: WO 00/26664

(43) International Publication Date: 11 May 2000 (11.05.00)

(21) International Application Number: PCT/IB99/01747

(22) International Filing Date: 29 October 1999 (29.10.99)

(30) Priority Data:

98/9866	29 October 1998 (29.10.98)	ZA
98/9867	29 October 1998 (29.10.98)	ZA
99/1831	8 March 1999 (08.03.99)	ZA

(71)(72) Applicant and Inventor: BRITS, Willem, Hendrik [ZA/ZA]; 29 Boekenhout Street, Dalpark, Extension 5, 1541 Brakpan (ZA).

(74) Agent: JOHN & KERNICK; Kernick House, Howick Close, Waterfall Park, 1685 Midrand (ZA).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

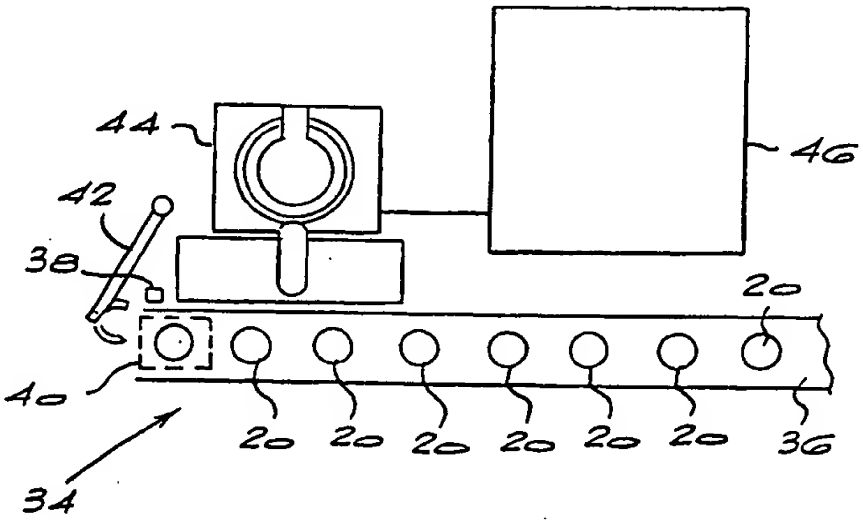
Published

Without international search report and to be republished upon receipt of that report.

(54) Title: ASSAYING

(57) Abstract

This invention relates to a method for assaying an ore sample to determine the concentration of gold and PGMs therein. The method comprises the steps of preparing an ore sample, combining the prepared ore sample with a lead–containing flux, inductively heating the combination (typically at a predetermined reference temperature profile) to form a fusion of slag and lead containing the gold and PGM's in the sample and separating the lead from the slag. The invention also covers a new flux for the process, the flux containing sodium hydroxide, a container for mixing the flux and an ore sample and an apparatus for separating molten lead from slag.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

ASSAYING

BACKGROUND OF THE INVENTION

This invention relates to assaying.

In order to plan and manage mining operations and to estimate recoverable ore reserves it is necessary to have the facility to determine the concentration in ore samples of precious metals, typically gold and PGMs (platinum group metals including platinum, palladium, rhodium, osmium, indium and ruthenium). It is already known to use a fire assay process for this purpose. In fire assay, PGMs and gold are separated from gangue materials by collection into either lead or nickel sulphide at temperatures of around 1200 - 1450°C. This is achieved by mixing an aliquot of the sample with a flux containing either lead oxide, for the lead collection, or a combination of nickel carbonate and sulphur, for the nickel sulphide, with other chemicals. A flux containing lead oxide which has been found to work satisfactorily in the conventional fire assay method consists of calcium carbonate, lead oxide, borax and silica, and a carbon source such as activated carbon, maize meal or flour. This mixture is placed into a ceramic crucible, which in turn is placed into an electric or gas fired furnace and heated to an appropriate temperature for a period of about 90 minutes. During this time the mixture melts and, because their chemical affinity, PGMs and gold are collected into either lead or nickel sulphide. On cooling the lead or nickel sulphide is separated from the gangue material and the PGMs and gold content determined by a number of analytical techniques.

The advantage of Fire Assay collection over other analytical procedures is that it effectively concentrates PGMs and gold from a large sample aliquot into a media which is much more amenable to further treatment for the separation and analysis of the PGMs and gold. Fire Assay is, therefore, used extensively in all laboratories engaged in the analysis of samples containing precious metals and, indeed, is an essential stage in the analysis of lower grade samples such as concentrates, feeds and tails.

In electrically heated furnaces, radiant heat from resistive elements is applied to the prepared ore samples. It is difficult to maintain constant operating conditions in an electrical furnace. Furthermore, resistive elements are fragile and deteriorate over time. This variability in furnace conditions detrimentally affects the accuracy of assay results and gives rise to excessive repeat rates.

Gas fired furnaces on the other hand are noisy and require frequent maintenance, which lengthens the average time taken to complete an assay.

The flux used in assaying contains lead and is environmentally hazardous, either in dust form during the flux preparation stage, or as fumes which form during the fusion and cuppelation stages of the process. Personnel involved in the assaying process require monitoring of lead blood levels every six months, which is expensive and disconcerting to the persons involved.

The fusion pots used for fusion of the flux / ore sample combinations are brittle and break easily. In order to overcome this difficulty, each assay is duplicated or triplicated, to ensure that at least one successful assay result is

obtained, which increases the overall assaying costs. Further, the duplicated or triplicated samples are fused in different furnaces in order to compensate for the variability in furnace conditions.

The recovery of lead from the fusion slag is also hazardous as the slag is broken up, usually manually, by impact to liberate globules of lead entrapped in the slag. Slivers of slag are sharp and necessitate the wearing of adequate safety equipment. Generally, not all lead globules are usually liberated from the slag, leading to an inevitable loss of lead.

Current assay techniques are labour intensive and, therefore, prone to human error. The average time taken to complete an assay normally exceeds twelve hours. It is desired to improve the accuracy, the turnaround time and the safety aspects of known prior art assaying techniques.

SUMMARY OF INVENTION

According to a first aspect of the invention there is provided a method for assaying an ore sample to determine the concentration of selected metals therein, comprising the steps of:

preparing an ore sample;

combining the prepared ore sample with a lead-containing flux;

inductively heating the combination typically at a predetermined reference temperature profile to form a fusion of slag and lead containing the metals in the sample;

separating the lead from the slag; and

determining the concentration of the selected metals in the sample.

The predetermined reference temperature profile is determined by the characteristics and amount of the ore sample and/or the flux.

The sample may be supplied with a constant temperature profile, or it may be supplied with a varied temperature profile. For example, the sample is supplied with a high level of heat for a predetermined first period of time and then supplied with a lower level of heat for a predetermined second period of time to form the fusion of slag and lead.

The sample of ore and flux is preferably mixed in a container made from carbon-based material, and the container is inductively heated together with the sample and flux.

Preferably, the container is made from plastics material and comprises a lid which is arranged to close the container sealingly.

The container may also comprise identification means in the form of a bar code for identifying the sample contained therein.

Advantageously, the flux contains sodium hydroxide.

The sample is preferably heated inductively within a graphite or more preferably within a zirconium melting pot in an induction furnace.

Advantageously, molten lead separated from the slag is poured into a chilled mould, to provide a solid lead button.

The solid lead button may then be analyzed by way of spark analysis or laser ablation.

According to a second aspect of the invention there is provided a method as described above including the steps of storing information on each sample on a central database, providing each bottle into which the sample is poured with a unique identification means such as a bar code identifying each bottle, for example by scanning, before inserting it into the induction furnace, correlating the identity of the bottle and information on the central database, and applying a predetermined reference temperature profile to the sample, according to the information on the sample stored in the database.

Preferably, each lead button is stamped with an identification code.

According to a third aspect of the invention there is provided a receptacle for separating molten lead from slag, the receptacle comprising a base with a side wall extending from the base, the side wall defining a top opening into the receptacle, and the side wall having a collecting cavity, wherein the collecting cavity is sized to collect a predetermined amount of molten lead.

Advantageously, the collecting cavity is located proximate the top opening of the receptacle.

Preferably, barrier means is provided between the collecting cavity and the

opening of the receptacle, to trap molten lead in the collecting cavity.

The collecting cavity is preferably formed within a removable plug which is attachable to the side wall of the receptacle.

Advantageously, the receptacle includes a first spout located at the top opening, above the collecting cavity.

The receptacle preferably includes a second spout located at the top opening, diametrically opposed to the first spout.

Advantageously, the receptacle is also a melting pot for an induction furnace.

The receptacle is preferably made from graphite, more preferably zirconium.

According to a fourth aspect of the invention there is provided a method for separating molten lead from slag, in the receptacle described above, the method including the steps of:

1. introducing a slag with a predetermined amount of molten lead therein into the receptacle;

2. rotating the receptacle in a first direction toward the collecting cavity so that the molten lead fills and is retained within the cavity, rotating the receptacle further so that the slag is discharged from the opening to the receptacle;

3. rotating the receptacle so that the molten lead flows out of the cavity and is discharged out of the opening to the receptacle, for example, by rotating the receptacle in a second direction, opposite to the first direction; and

4. collecting the lead discharged from the opening of the receptacle.

Advantageously, the receptacle is a melting pot surrounded by an electromagnetic coil and the electromagnetic coil is rotated together with the melting pot.

According to a fifth aspect of the invention there is provided a flux composition for use in fire assaying of ore samples, the composition containing sodium hydroxide.

Preferably, the flux composition comprises 20% to 60%, more preferably 25% to 40%, by weight, sodium hydroxide.

The composition may further comprise:

20% to 60%, preferably 25% to 40%, by weight, lead oxide; and
20% to 60%, preferably 25% to 40%, by weight, borax.

Advantageously, the composition may also comprise silver nitrate.

According to a sixth aspect of the invention, there is provided a sealed container, made from a carbon-based material, containing a charge of flux

composition as described above for the fire assay of a sample of ore.

Preferably, the container includes a replaceable lid.

Typically, the container is made from a combustible material, such as a plastics material.

Advantageously, the container is made from a mixture of plastics material and a flux material, such as calcium carbonate.

Typically, the container is made from a mixture of 60 to 80%, by weight, calcium carbonate and 40 to 20%, by weight, plastics material.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which Figures 1 to 7 illustrate embodiments of the invention.

Figure 1 is a schematic flow diagram of a process according to the invention for assaying an ore sample to determine the concentration of selected metals therein;

Figure 2 is a pictorial view of a bottle containing flux;

Figure 3 is a schematic top plan view of an apparatus according to the invention for carrying out the process of Figure 1;

Figure 4 is a cross-sectional view of an induction furnace according to the invention;

Figure 5 is a pictorial view of a preferred melting pot according to the invention;

Figure 6 is a cross-sectional view of the melting pot shown in Figure 5, along the line 6-6; and

Figure 7 is a cross-sectional view of the induction furnace shown in Figure 4, shown in two positions in which matter is discharged from the furnace.

DESCRIPTION OF AN EMBODIMENT

Referring to Figure 1, according to the invention there is provided a method of assaying an ore sample, the method including the steps of preparing an ore sample 10, mixing the ore sample 10 with a flux 12 which includes lead oxide, to form a mixture 14, inductively heating the mixture 14 to form a fusion of slag 16 and lead 18 containing gold and PGMs, separating the lead 18 from the slag 16 and determining the amount of gold and PGMs in the lead.

In the sample preparation step, an ore sample is logged and its bulk weight determined. The ore sample is then dried, comminuted and sieved and split into a number of aliquots which are deposited into storage containers in the

form of small plastic bottles, each of which already contains a flux.

Information on the sample, such as weight, type etc is entered onto a computer and identification means in the form of a bar code label is produced for each sample. The unused portion of the ore sample is sealed in a storage container and identified by means of a bar code label indicating identification, origin and date of assay.

A typical bottle 20 into which an aliquot ore sample is placed is shown in Figure 2. The bottle 20 is made from a plastics material (polypropylene) and has a lid 22 (made from polyethylene) which engages sealingly with the opening into the bottle 20. A charge of flux 26 is shown in the bottle 20. A charge of flux is a sufficient amount of a particular composition of flux for carrying out the fire assay of an aliquot of a particular ore sample. Each bottle 20 is identified by identification means in the form of a printed bar code label 28 indicative of sample identification and weight, which is attached to the top surface of the lid 22. The bottle is also provided with a ridge 30 just below the lid 22.

In a preferred embodiment of the invention the bottle 20 is made from a mixture of plastics material (such as polypropylene) and a flux material. The bottle typically comprises 60 to 80% calcium carbonate and 40 to 20% polypropylene. The advantages of including flux with the plastics material is discussed below.

The flux 26 comprises:

20% to 60%, preferably 25% to 40%, by weight, sodium hydroxide (NaOH);

20% to 60%, preferably 25% to 40%, by weight, lead oxide;

20% to 60%, preferably 25% to 40%, by weight, borax; and

may also contain a small amount (0 to 1%) of silver nitrate.

Each bottle 20 contains a predetermined charge and constitution of flux. The bottles are conveniently filled with flux on a production line at a production site and then transported to the site at which assaying takes place. The charge of flux, which varies from 200 to 450g, depends on the amount and type of sample being assayed. Generally, there is a ratio of flux to sample of 4:1 to 6:1, by weight. The constitution of the flux depends on the characteristics of the sample being assayed. For example, a higher amount of borax is added for samples containing higher concentrations of base metals and a higher amount of sodium hydroxide is added for samples containing high amounts of silicates.

It is important that the lid 22 engages sealingly with the opening to the bottle 20 to ensure that the sodium hydroxide (NaOH) which is corrosive and hygroscopic does not come into contact with the atmosphere during transportation and storage of the bottle and flux.

In the process, the lid 28 of the bottle 20 is removed an aliquot sample of ore is added to a bottle 20 containing flux 26, the lid 28 is applied back onto the bottle 20 and the sample and flux is combined by merely shaking the bottle.

Previously, mixing containers were used which caused spillages and contamination between samples. Thus, the bottle 20 conveniently provides a package containing a required charge of flux which is also used to combine the aliquot sample and the flux.

It is envisaged that the sample preparation step is automated as a series of mechanically linked steps, enabling the preparation of an ore sample for assaying without the need for manual intervention.

Referring to Figure 3, bottles 20 which contain ore sample combined with flux are loaded onto a sample loader 34 which comprises a conveyor belt 36, an optical sensor 38, a bar code reader 40, and a mechanical gripper arm 42. In use, the optical sensor 38 senses the presence of a bottle 20, the bar code reader 40 (positioned above the bottle, and shown in dotted outline) scans the bar code 28 on the lid of the bottle 20 and the gripper arm 42 grips the bottle at the ridge 30 and transfers it into an induction furnace 44 which is powered by a generator 46. The conveyor 36 conveys the next bottle 20 in line with the sensor 38 and this next bottle is then ready to be transferred into the induction furnace 44. Once placed in the induction furnace 44, the identity of the bottle 20 is compared to the information stored on the central database and the bottle 20 is heated at a temperature profile that corresponds to the ore sample and flux contained within the bottle 20.

Referring to Figure 4, the induction furnace 44 includes a removable melting pot 46 for melting the sample and flux. The melting pot 46 may be made from any material that can sustain temperatures of up to 1500°C and which is not adversely affected by electromagnetic waves from an induction coil. For example, graphite or zirconium may be used. Zirconium is

preferred because it is resistant to sodium hydroxide fusions and does not oxidise as readily as graphite at high temperatures. Zirconium also has a high melting point of 1850°C, well above the operation temperatures of the induction furnace. It is important that the temperature of the melting pot 46 is monitored and thermocouples 49 are provided on the melting pot 46 for this purpose. The melting pot 46 is surrounded by a barrier 47 of ceramic material (1600 heat isolating) which in turn is surrounded by an induction coil 48. The induction coil 48 is surrounded by a shunt 51 that directs electromagnetic waves from the coil 48 toward the melting pot 46. The abovementioned components are housed in a housing 50 which is made from a ceramic material (polyester board GPO3). The furnace 44 also has a lid 52 which has a backing 54 also made from the ceramic material and an underside 56, made from alumina or zirconia based ceramic material, which closes the opening 58 into the melting pot 46, when the lid 52 is closed. It is important that the lid 52 closes the melting pot 46 sufficiently to create a reducing atmosphere therein to minimize oxidation of the melting pot 46 at the high temperatures within the furnace.

Once a bottle 20 has been inserted into the melting pot 46 the lid 52 is closed, and the bottle 20 and mixture of sample and flux therein are heated according to a predetermined temperature profile which is controlled by the amount of power applied to the induction coil. The temperature profile may be selected according to the amount and characteristics of ore which is being assayed and also the amount and characteristics of the flux 26.

In a typical example where the temperature profile is kept constant, the melting pot 26 is heated to about 900° and the flux and sample is inserted into the melting pot 26. The coil 48 is supplied with 15-30 kW of electrical

energy from the generator 46 for a predetermined first period of time (usually 20 to 30 seconds) to heat the pot to about 1250°C and then dropped to 10 to 12kW for a predetermined second period of time (usually 20 to 30 seconds), maintaining the temperature of the melting pot at about 1250°C. Thus, fusion of the ore and flux takes from 45 to 90 seconds, generally approximately 60 seconds.

If necessary, the sample and flux may be heated at a predetermined varied temperature profile, for example by first heating the flux and sample to about 1250°C for a first period of time (20 – 30 seconds) to melt the sample and flux and to then decreasing the temperature to about 1000°C for a second period of time (20 – 30 seconds), while the gold and PGMs are collected by the lead.

Another important aspect of the invention is that the temperature profile applied to each sample can be computer-controlled and thus the heating conditions can be accurately controlled, according to the identification made by the bar code reader. Information on each sample, such as sample type, sample weight, flux weight, flux composition, fusion conditions (i.e. temperature profile) is stored on a central database. Each sample is identified before it is added to the furnace and it is then heated according to a predetermined temperature profile. The system can also be used to subject similar ores, or ores from the same area, to similar or the same conditions, to ensure consistent assay results.

Fusion of the ore and flux is extremely quick and the alternating electro-magnetic waves (eddy waves) from the induction coil causes a violent stirring action of molten lead within the crucible which results in complete

collection of gold and PGMs by the lead within about 60 seconds of power being applied to the induction furnace.

During heating, the temperature of the melting pot must be monitored by the thermocouples 49 and by altering the energy applied to the induction coil 48 to ensure that the temperature of the molten lead and flux remains within a preferred temperature range of between 1150 °C and 1300°C. If the temperature exceeds 1450°C chrome III within the sample will be converted to chrome V and the chrome metal formed can trap gold and PGM's and negatively affect results. If the temperature drops too low (below 900°C), the slag will begin to solidify and it is then difficult to separate the slag from the lead.

The ceramic housing 50 ensures that, while the temperature within the crucible 46 can reach up to 1400°C, the outer surface of the ceramic housing 50 does not reach more that 60 to 100°C. This is because the ceramic housing 50 is not heated by eddy waves from the induction coil 48. The ceramic barrier 47 (which is not heated by the induction coil) serves to insulate the crucible 46 so that radiant energy is isolated within the crucible.

The advantage of the flux 26 over known flux compositions is that the sodium hydroxide has a melting point of 318°C, which is much lower than the melting point of CaCO3 , used in conventional fire assay processes. Thus, when the flux 26 is added to the crucible 46 in the induction furnace 46 (which is normally preheated a temperature of about 1000°C), the sodium hydroxide melts, wets the sample and flux, and retards spattering and boiling when power is applied to the induction furnace. The sodium hydroxide then reacts with silicates in the sample to form slag. Up to now it

has not been possible to use sodium hydroxide in conventional fire assay processes as these processes make use of clay pots and the sodium hydroxide would react with silica in the pots and destroy them during heating. The sodium hydroxide does not however have this effect on a graphite or zirconium melting pot 46. Also, there has been no feasible way of storing and transporting NaOH, because it is hygroscopic, and the sealed containers address this problem. Furthermore, fire assay flux used in the past containing calcium carbonate cannot be used in an induction furnace as it will blow out during rapid heating of the melting pot 46.

Thus, the flux 26, comprising sodium hydroxide makes it possible to rapidly melt an ore sample in an induction furnace as described above without losing flux and ore sample in the process.

The plastics bottle 20 is also an important part of the heating process as it provides a carbon source for reducing the lead oxide to produce molten lead. The inclusion of flux (calcium carbonate) with the plastic is to replace excess plastic which is merely burnt away, and to reduce flames and smoke during heating.

Referring back to Figure 3, after the sample has been heated in the induction furnace 44, the molten sample, which comprises lead containing gold and PGM's from the sample, and slag, is separated.

The mixture of slag and lead may be poured from the melting pot 46 into another receptacle and the lead and slage separated in that receptacle. However, according to a preferred embodiment of the invention, the melting pot 46 also performs the function of separating the molten lead from the

slag.

Figure 5 shows a melting pot 46 which is arranged to be received in an induction furnace, and which serves the dual purpose of separating molten lead from slag. As discussed above, the melting pot 46 may be made from a material such as graphite or zirconium. Zirconium is preferred as molten lead does not adhere to the heated zirconium. This is advantageous as the melting pot 46 is intended to be used for numerous samples and this limits the contamination of subsequent samples from previous samples.

Referring to Figure 6, the melting pot 46 comprises a base 60 with a side wall 62 extending from the base and defining a top opening 64. A first spout 66 is provided at the top opening 64 for decanting molten material from a melting zone 68 within the melting pot 46. A second spout 70 is provided at the top opening 64 and is diametrically opposed to the first spout 66.

A collector 72 defining a collecting cavity 76 is provided on the side wall 62 of the melting pot 46, below the first pouring spout 66. The collector 72 may be formed integrally with the pot but is preferably removable in the form of an externally threaded plug which screws into a complimentary threaded aperture 74 in the side wall 62. The collecting cavity 76 is sized to accommodate only a predetermined amount of molten lead (i.e. the amount of lead in a molten assay sample). In a typical example, the collecting cavity 76 is sized to accommodate only 64 grams of lead from a flux containing 70 grams of lead oxide. Depending on the amount of lead in a molten sample the cavity 76 may be selected to contain from 35 to 110 grams of lead. The removable plug is advantageous as different size

collecting cavities 76 can be selected and provided for different samples that are being assayed. This is important as the zirconium melting pot 46 is expensive to manufacture. The collector 72 is located proximate the top opening 64, and away from the melting zone 68, where the pot is corroded during fusion, so that the collector is not damaged during fusion.

In addition to what is stated above, the plug 72 has a side wall 78 which protrudes from the side wall 62 of the side wall 62 of the melting pot 46. The side wall 78 is advantageous as it provides a barrier that helps to collect lead in the collecting cavity 76.

As mentioned above, it is important to monitor the temperature of the melting pot 46 during operation and thermocouples 80 are provided in the base 60 of the melting pot 46, for this purpose.

Once the sample and flux have been fused to provide a slag and when the gold and PGM's have been collected in the molten lead, the molten lead and slag are separated by rotating the melting pot 46 to tip firstly the slag and then secondly and separately the lead from the melting pot 46. In this embodiment of the invention the melting head is not removed from the furnace and separation is conveniently achieved by tipping the whole of the induction furnace, i.e. tipping the induction coil together with the melting pot 46.

Referring to Figure7, after a sample and flux have been fused, in a melting pot 46 in an induction furnace 44, the furnace 44 is rotated in a first direction "A" toward the first spout 66 and the lead collector 72. The furnace 44 is rotated through approximately 160°. Because of different

densities and viscosities, slag 80 is poured out of the melting pot 46 via the first spout 66 and all of the molten lead 82 is trapped in the lead collector 72. The side wall 78 of the collector 72 forms a barrier that protrudes from the side wall of the melting pot 46 and assists in the collection of the molten lead.

The slag that is poured out of the melting pot 46 is poured into a waste bin (not shown). After all of the slag has discharged from the melting pot 46, the furnace is rotated back into an upright position.

The furnace 44 is then rotated in a second direction "B" which is opposite to the first direction "A", also through about 160°. Molten lead 84 within the melting pot 46 is then discharged out of the melting pot 46, via the second spout 70 into a water-cooled mould 86.

It is important to keep the melting head 46 at a temperature above 900°C during the above process so that the molten lead and slag are properly separated and so that molten lead is not left behind within the melting head 46. In this regard, the induction coil 48 extends to the spouts 68 and 70 to heat them and ensure that they do not cool to below 900°C.

The mould 86 is water-cooled to about 10°C and the molten lead poured into the mould solidifies within about 5 to 10 seconds to form a lead button.

Rapid cooling of the molten lead stops gold and PGMs in the lead from forming layers ensuring that the concentration of gold and PGMs within the lead button is homogenous.

Thereafter, the button is removed from the mould and stamped with an identification number which corresponds to the bar code which was read at the beginning of the process and the buttons are stored on a button storage rack, ready to be analyzed.

The amount of gold and PGMs within the button may be analysed by any conventional processes, for example by cupellation or lead dissolution. The lead cupellation processes takes approximately 2,5 hours to perform and the lead dissolution process takes approximately 8 hours to perform. The main advantage of homogenous button 74 produced by the process of the invention is that it can be analysed by way of much quicker processes such as spark analysis and laser ablation. In prior art processes, due to the separation and cooling techniques employed, PGMs and gold form layers within the lead and the lead cannot be analysed by spark analysis or laser beam ablation. As spark analysis and laser ablation only takes approximately 30 seconds, the use of these processes on the lead buttons produced by the invention dramatically reduces the time taken up by analysis. By using spark analysis or laser ablation, the whole fire assay and analysis process could be done in far less time than the twelve hour turn around time of known processes.

In addition to the above advantages, the fire assay method and apparatus according to the invention provides a much more comfortable working environment than the hot and uncomfortable working environment of prior art furnaces. The apparatus according to the invention also takes up far less work space and means that assay laboratories are more financially viable. Furthermore, the system requires less power than prior art processes and reduces replacement parts such as elements, clamps and braids for furnaces,

loading and pouring equipment and clay crucibles. Lastly, the apparatus and process of the invention can provide an automated process that is not labour intensive.

Example1

A typical charge of flux according to the invention for analyzing 5g concentrate ore samples from a reef in Rustenburg in South Africa, to test for platinum, palladium, rhodium and gold has the following amount and composition:

80g Borax
85g Litharge
45g NaOH

The flux is provided in a sealed plastic bottle. The bottle has a receptacle portion that weighs from 35 to 45g and a lid that weighs ±10g. The lid is made from polyethylene and the receptacle is made from 40%, by weight, polypropylene and 60%, by weight, calcium carbonate.

Example2

A typical charge of flux according to the invention for analyzing 75g feed ore samples from a reef in Rustenburg in South Africa, to test for platinum, palladium, rhodium and gold has the following amount and composition:

80g Borax
85g Litharge

60g NaOH

The flux is provided in a sealed plastic bottle. The bottle has a receptacle portion that weighs from 50 to 60g and a lid that weighs ±10g. The lid is made from polyethylene and the receptacle is made from 40%, by weight, polypropylene and 60%, by weight, calcium carbonate.

Example3

A typical charge of flux according to the invention for analyzing 100g tail ore samples from a reef Rustenburg in South Africa, to test for platinum, palladium, rhodium and gold has the following amount and composition:

160g Borax
85g Litharge
140g NaOH

The flux is provided in a sealed plastic bottle. The bottle has a receptacle portion that weighs from 60 to 75g and a lid that weighs ±10g. The lid is made from polyethylene and the receptacle is made from 40%, by weight, polypropylene and 60%, by weight, calcium carbonate.

Example 4

This Example shows a typical method according to the invention, in which feed ore samples from a mine in Rustenburg, South Africa, were analyzed. Feed ore samples were prepared by drying feed tail ore, comminuting and sieving it, and weighing aliquot samples of 75g of ore.

The lid of a sealed container as described in Example 2 and containing a flux composition according to Example 2 was opened. An aliquot ore sample was added to the container and the lid was replaced. The container was then shaken to combine the ore sample and the flux composition.

The container was then inserted into a triple pitch impregnated graphite pot which was surrounded by an induction coil in an induction furnace. The induction coil was powered by a 15kW induction generator.

The graphite pot had been pre-heated to 1250°C. Once the bottle had been inserted into the melting pot, the lid of the furnace was closed and the heat of the pot was maintained at 1250°C for 90 seconds, by applying 15kW of power to the coil at 6.5kH. Although it is possible and sometimes advantageous to heat the sample according to a varied temperature profile, the temperature in this example was kept constant at 1250°C during melting and fusion.

After 90 seconds the power to the induction furnace was reduced and the molten sample of lead and slag were poured into and separated in a heated separator as described in South African provisional patent application no. 99/1831 which is incorporated herein by reference.

The separated molten lead was poured into a chilled mould and formed into a solid lead button within 10 seconds.

The above process was carried out with 10 aliquot samples of ore. The solid lead buttons were then analyzed by cupellation and lead dissolution methods and the results of the analysis are set out in Table 1 below:

TABLE 1

	Induction									
	Lead dissolution					Cupellation				
	Pt	Pd	Rh	Au	4T	Pt	Pd	Rh	Au	4T
	2.03	2.28	0.198	0.293	4.80	2.32	2.42	0.188	0.380	5.31
	2.17	2.37	0.198	0.285	5.02	2.25	2.27	0.188	0.275	4.98
	2.03	2.33	0.198	0.280	4.84	2.15	2.26	0.188	0.258	4.86
	2.14	2.27	0.193	0.283	4.89	2.1	2.34	0.188	0.300	4.93
	2.12	2.38	0.195	0.278	4.97	2.08	2.28	0.180	0.275	4.82
	2.17	2.39	0.193	0.285	5.04	2.41	2.32	0.180	0.298	5.21
	2.37	2.25	0.185	0.343	5.15	2.02	2.29	0.190	0.333	4.83
	2.07	2.33	0.198	0.233	4.83	2.23	2.4	0.193	0.268	5.09
	2.20	2.41	0.203	0.293	5.11	2.07	2.31	0.185	0.268	4.83
	2.13	2.27	0.190	0.343	4.93	2.07	2.25	0.190	0.275	4.79
Avg	2.14	2.33	0.195	0.292	4.96	2.17	2.31	0.19	0.29	4.96
%RSD	4.4	2.4	2.5	10.4	2.3	5.6	2.4	2.1	12.2	3.5
NiS Consensus	2.10	2.31	0.208	0.246	4.86	2.10	2.31	0.208	0.246	4.86

The same feed sample was tested in a nickel sulphide fire assay process known in the prior art. The results of these tests are set out in Table 2 below:

TABLE 2

	Fire Assay									
	Lead dissolution					Cupellation				
	Pt	Pd	Rh	Au	4T	Pt	Pd	Rh	Au	4T
	1.57	1.73	0.140	0.270	3.71	1.87	1.75	0.135	0.190	3.95
	2.14	1.94	0.160	0.260	4.50	1.73	1.78	0.140	0.200	3.85
	1.66	1.71	0.150	0.250	3.77	1.77	1.86	0.145	0.185	3.96
	1.84	1.96	0.160	0.220	4.18	1.98	1.99	0.153	0.260	4.38
	2.08	2.11	0.190	0.250	4.63	2.39	2.21	0.170	0.288	5.06
	2.03	2.14	0.180	0.280	4.63	1.97	2.01	0.158	0.318	4.46
	1.94	2.05	0.180	0.460	4.63	1.97	2.15	0.163	0.260	4.54
	2.07	2.14	0.190	0.230	4.63	1.96	2.25	0.173	0.250	4.63
	2.03	2.21	0.180	0.300	4.72	2.37	2.3	0.170	0.260	5.10
	2.23	2.32	0.200	0.280	5.03	2.23	2.2	0.180	0.253	4.86
Avg	1.96	2.03	0.173	0.280	4.44	2.02	2.05	0.159	0.246	4.48
%RSD	10.2	9.2	10.7	22.9	9.1	10.9	9.3	9.1	16.5	9.6
NiS Consensus	2.10	2.31	0.208	0.246	4.86	2.10	2.31	0.208	0.246	4.86

From Tables 1 and 2 it is clear that the results of the lead buttons prepared in the induction heating process according to the invention compare very well with the results the lead buttons prepared by the nickel sulphide fire assay process. In fact, the RSD for the induction process is significantly lower than that of the nickel sulphide fire assay process.

Example 5

Lead buttons from an ore sample, prepared by a process according to the invention as described in Example 4 were tested by spark analysis and were found to provide accurate results.

A tail sample from a reef in Rustenburg South African was treated in the same way as described in Example 4 to produce three lead buttons. The buttons were analysed by spark analysis and the results are set out below:

Pt	Pd	Rh	Au	Total PGM
0.53	0,20	0,07	0,07	0,87
0.54	0,19	0,06	0,04	0,83
0.55	0,19	0,06	0,04	0,84

Conventional cupellation techniques were carried out on lead buttons from the same sample and revealed a total PGM value of 0,82 grams per ton.

Example 6

The process according to the invention as described in Example 4 was carried out using a melting pot made of zirconium, except the ore sample

was replaced with silica. After fusion, it was found that the zirconium melting pot is superior to the graphite melting pot in that it did not oxidise as much at high temperatures as the graphite pot, and the molten lead does not adhere as much to the zirconium pot.

CLAIMS

1. A method for assaying an ore sample to determine the concentration of selected metals therein, comprising the steps of:

combining a prepared ore sample with a lead-containing flux;

inductively heating the combination to form a fusion of slag and lead containing the metals in the sample; and

separating the lead from the slag.

2. The method according to claim 1 wherein the combination is heated at a predetermined temperature profile.

3. The method according to claim 2 wherein the predetermined reference temperature profile is determined by the characteristics and amount of the ore sample and/or the flux.

4. The method according to claim 3 wherein the sample is supplied with a high level of heat for a predetermined first period of time and then supplied with a lower level of heat for a predetermined second period of time to form the fusion of slag and lead.

5. The method according to any one of the preceding claims wherein the sample of ore and flux are combined in a container made from carbon-based material, and the container, the sample, and the flux are inductively heated.

6. The method according to claim 5 wherein the container is made from plastics material and comprises a lid which is arranged to close the container sealingly.

7. The method according to claim 5 or 6 wherein the container includes identification means for identifying the sample contained therein.

8. The method according to claim 7 wherein the identification means is a barcode.

9. A method according to any one of the preceding claims wherein the flux contains sodium hydroxide.

10. The method according to any one of the preceding claims wherein the sample is heated inductively within a graphite melting pot in an induction furnace.

11. The method according to any one of the preceding claims wherein the sample is heated inductively within a zirconium melting pot in an induction furnace.

12. The method according to any one of the preceding claims wherein molten lead separated from the slag is poured into a chilled mould, to provide a solid lead button.

13. A method according to claim 5 including the steps of storing information on each sample on a central database, providing each container into which the sample is poured with a unique identification means,

identifying each container before inserting it into the induction furnace, correlating the identity of the container and information on the central database, and applying a predetermined reference temperature profile to the sample, according to the information on the sample stored in the database.

14. A method according to claim 13 wherein the identification means is a bar code and the bar code is identified with a scanner.

15. A method according to any one of the preceding claims wherein each solid lead button is stamped with an identification code.

16. A receptacle for separating molten lead from slag, the receptacle comprising a base with a side wall extending from the base, the side wall defining a top opening into the receptacle, and the side wall having a collecting cavity, wherein the collecting cavity is sized to collect a predetermined amount of molten lead.

17. A receptacle according to claim 16 wherein the collecting cavity is located proximate the top opening of the receptacle.

18. A receptacle according to claim 16 or 17 wherein barrier means is provided between the collecting cavity and the opening of the receptacle, to trap molten lead in the collecting cavity.

19. A receptacle according to any one of claims 16 to 18 wherein the collecting cavity is formed within a removable plug which is attachable to the side wall of the receptacle.

20. A receptacle according to any one of claims 16 to 19 including a first spout located at the top opening, above the collecting cavity.

21. A receptacle according to claim 20 including a second spout located at the top opening, diametrically opposed to the first spout.

22. A receptacle according to any one of claims 16 to 21 wherein the receptacle is also a melting pot for an induction furnace.

23. A receptacle according to any one of claims 16 to 22 made from graphite or zirconium.

24. A method for separating molten lead from slag, in the receptacle of claim 16, the method including the steps of:

1. introducing a slag with a predetermined amount of molten lead therein into the receptacle;

2. rotating the receptacle in a first direction toward the collecting cavity so that the molten lead fills and is retained within the cavity, rotating the receptacle further so that the slag is discharged from the opening to the receptacle;

3. rotating the receptacle so that the molten lead flows out of the opening to the receptacle; and

4. collecting the lead discharged from the opening of the receptacle.

25. A method according to claim 24 wherein the receptacle is a melting pot surrounded by an electromagnetic coil and the electromagnetic coil is rotated together with the melting pot.

26. A flux composition for use in fire assaying of ore samples, the composition containing sodium hydroxide.

27. The composition of claim 26 comprising 20% to 60%, by weight, sodium hydroxide.

28. The composition of any one of claims 26 to 28 further comprising:

20% to 60%, by weight, lead oxide; and
20% to 60%, by weight, borax.

29. The composition of claim 27 comprising 20% to 50%, by weight sodium hydroxide, 25% to 40% lead oxide and 25% to 40% borax.

30. The composition of any one of claims 26 to 30 further including silver nitrate.

31. A sealed container, made from a carbon-based material, the container containing a charge of flux composition including sodium hydroxide, for use in the fire assay of a sample of ore.

32. A container according to claim 31 including a replaceable lid.

33. A container according to claim 31 or 32 made from a combustible material.

34. A container according to claim 33 made from a plastics material.

35. A container according to claim 34 made from a mixture of plastics material and a flux material.

36. A container according to claim 35 wherein the flux material is calcium carbonate.

37. A container according to claim 36, the mixture including 60 to 80%, by weight, calcium carbonate.

FIG 1

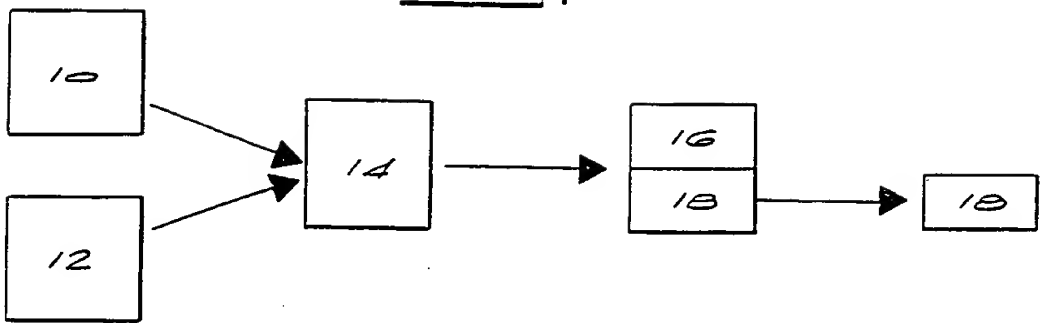


FIG 2

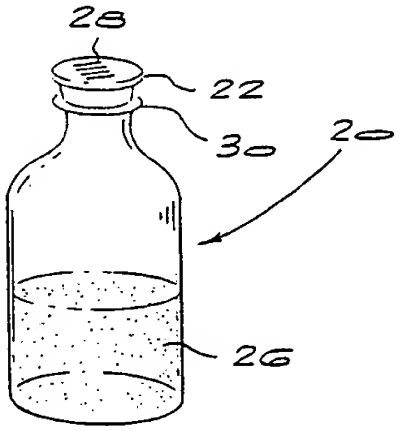
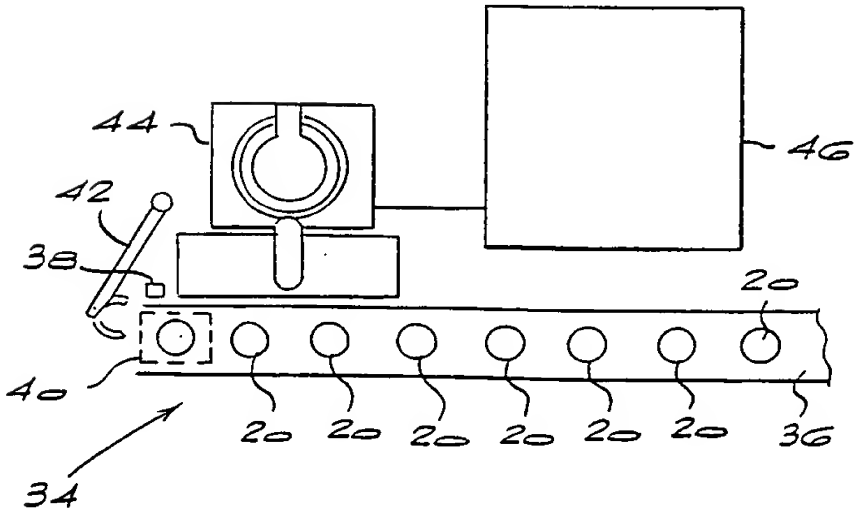


FIG 3



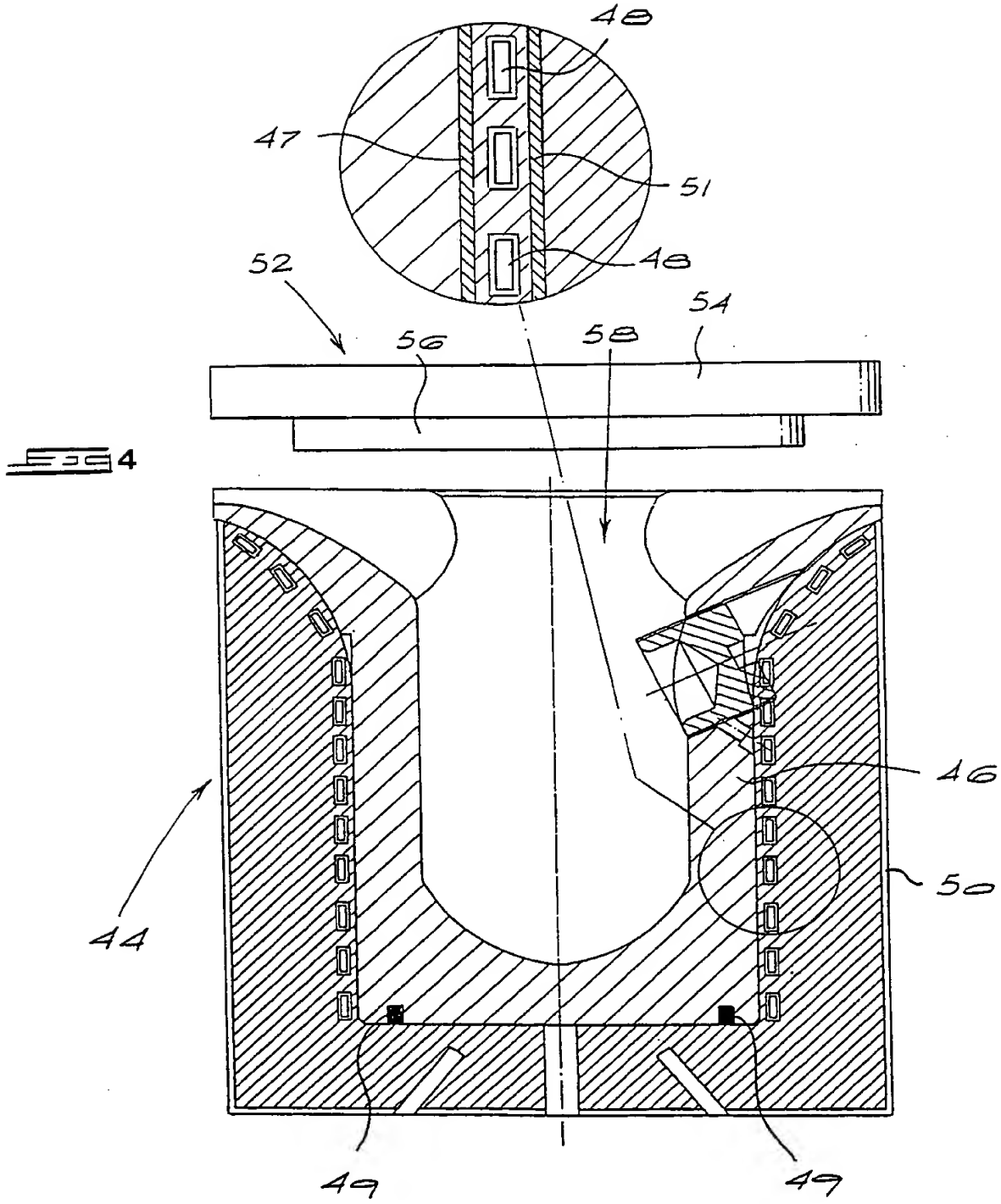


Fig 4

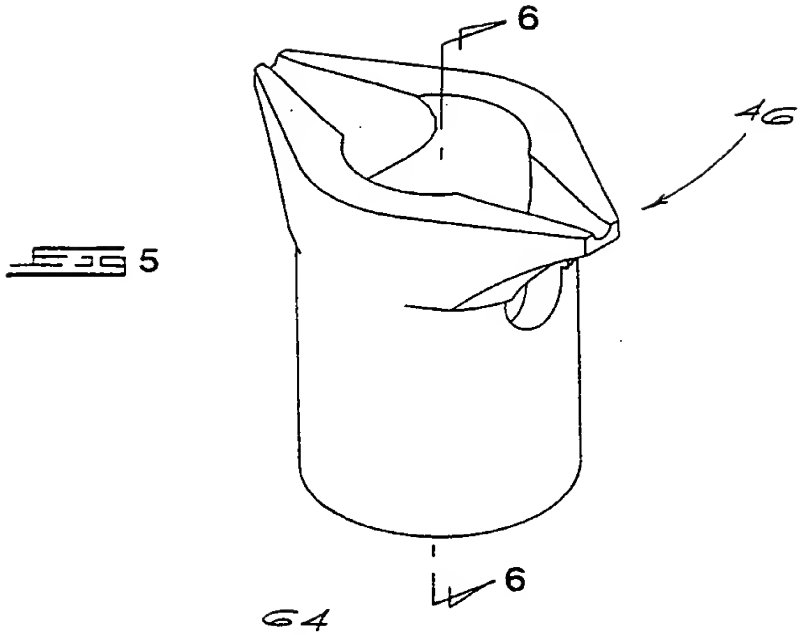


Fig 5

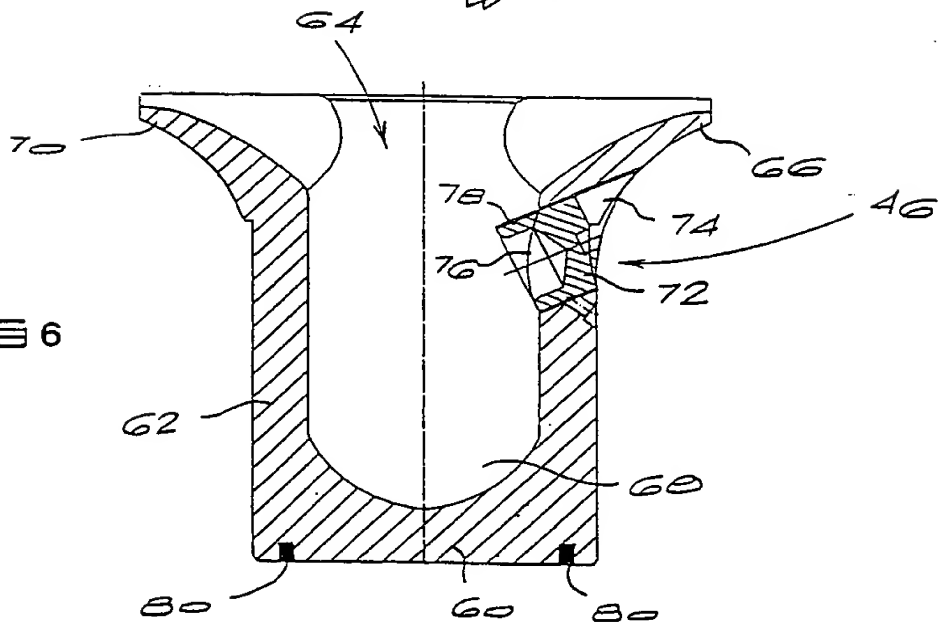
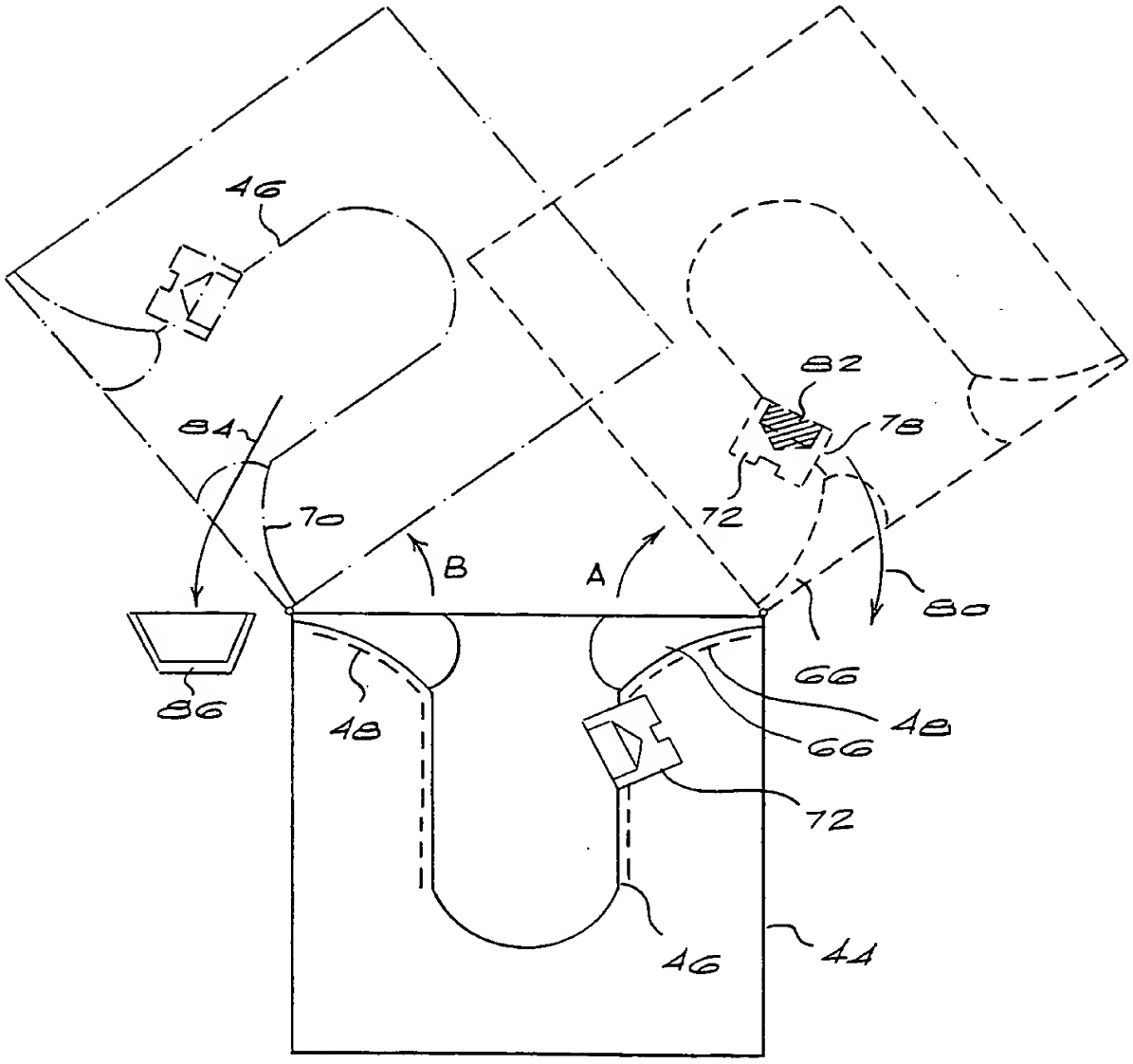


Fig 6


46
84
70
B
A
82
78
72
80
86
48
66
48
66
72
46
44

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G01N 33/20 — A3

(11) International Publication Number: **WO 00/26664**

(43) International Publication Date: 11 May 2000 (11.05.00)

(21) International Application Number: PCT/IB99/01747

(22) International Filing Date: 29 October 1999 (29.10.99)

(30) Priority Data:

98/9866	29 October 1998 (29.10.98)	ZA
98/9867	29 October 1998 (29.10.98)	ZA
99/1831	8 March 1999 (08.03.99)	ZA

(71)(72) Applicant and Inventor: BRITS, Willem, Hendrik [ZA/ZA]; 29 Boekenhout Street, Dalpark, Extension 5, 1541 Brakpan (ZA).

(74) Agent: JOHN & KERNICK; Kernick House, Howick Close, Waterfall Park, 1685 Midrand (ZA).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

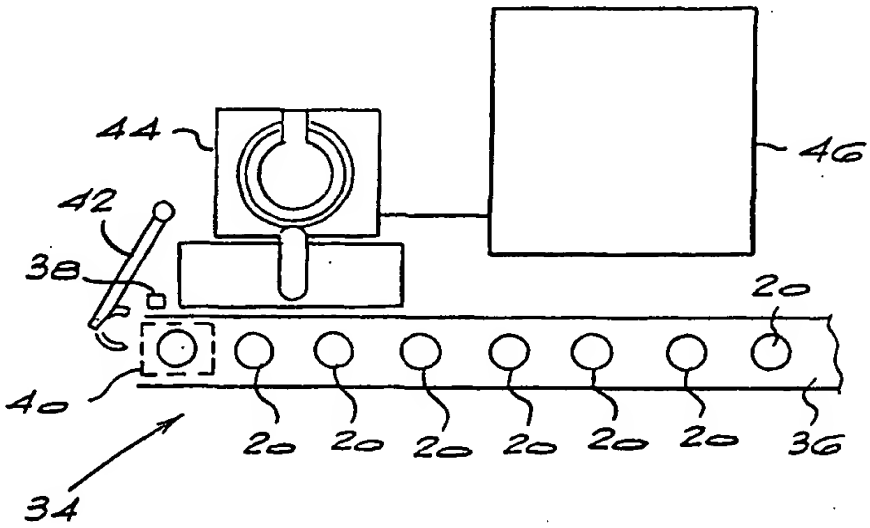
Published
With international search report.

(88) Date of publication of the international search report:
31 August 2000 (31.08.00)

(54) Title: ASSAYING

(57) Abstract

This invention relates to a method for assaying an ore sample to determine the concentration of gold and PGMs therein. The method comprises the steps of preparing an ore sample, combining the prepared ore sample with a lead–containing flux, inductively heating the combination (typically at a predetermined reference temperature profile) to form a fusion of slag and lead containing the gold and PGM's in the sample and separating the lead from the slag. The invention also covers a new flux for the process, the flux containing sodium hydroxide, a container for mixing the flux and an ore sample and an apparatus for separating molten lead from slag.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

INTERNATIONAL SEARCH REPORT

Int ational Application No
PCT/IB 99/01747

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01N33/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 793 155 A (FLOOD ET AL.) 19 February 1974 (1974-02-19) abstract column 4, line 14 - line 49; figure 1	1-15
A	US 4 799 999 A (MEDVINSKY ET AL.) 24 January 1989 (1989-01-24) abstract column 3, line 20 -column 4, line 37; figure 3	1-15
A	US 4 238 450 A (BREDEWEG ET AL.) 9 December 1980 (1980-12-09) abstract column 2, line 29 -column 4, line 49; figure 2	1-15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 May 2000	02.06.00

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Kempf, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/IB 99/01747

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 289 758 A (NIPPON SUBLANCE PROBE ENGINEER) 29 November 1995 (1995-11-29) abstract page 3, paragraph 2 -page 4, paragraph 2; figures 1,2	16-30
A	WO 96 41161 A (MOLTEN METAL TECH INC) 19 December 1996 (1996-12-19) abstract page 5, line 8 - line 9; figure 1	16-30
A	GB 1 251 731 A (BALZERS) 27 October 1971 (1971-10-27) abstract page 1, line 10 - line 18 page 2, line 108 - line 116; figure 1	31-37
A	US 3 751 965 A (KRAUS T) 14 August 1973 (1973-08-14) abstract column 2, line 30 - line 65; figure 1	31-37

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 99/01747

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [X] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-15

   Method for assaying a sample

2. Claims: 16-30

   A receptacle for separatig molten lead from slag

3. Claims: 31-37

   A sealed container.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ..tional Application No
PCT/IB 99/01747

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3793155 A	19-02-1974	US 3652427 A	28-03-1972
US 4799999 A	24-01-1989	AU 1294388 A	02-11-1988
		EP 0362203 A	11-04-1990
		ES 2007173 A	01-06-1989
		JP 3188371 A	16-08-1991
		WO 8807674 A	06-10-1988
		ZA 8802207 A	22-02-1989
US 4238450 A	09-12-1980	NONE	
GB 2289758 A	29-11-1995	CN 1126317 A	10-07-1996
		IT T0950339 A	24-11-1995
		KR 184720 B	15-05-1999
WO 9641161 A	19-12-1996	AU 5971196 A	30-12-1996
		ZA 9604419 A	09-12-1996
GB 1251731 A	27-10-1971	CH 486680 A	28-02-1970
		DE 1934935 A	22-10-1970
		FR 2027530 A	02-10-1970
		NL 6900828 A,B	04-05-1970
US 3751965 A	14-08-1973	AT 307373 B	15-04-1973
		CH 530003 A	31-10-1972
		DE 2050558 A	20-01-1972
		FR 2105800 A	28-04-1972
		GB 1318127 A	23-05-1973
		NL 7012998 A	18-01-1972

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G01N 33/20 A2

(11) International Publication Number: WO 00/26664

(43) International Publication Date: 11 May 2000 (11.05.00)

(21) International Application Number: PCT/IB99/01747

(22) International Filing Date: 29 October 1999 (29.10.99)

(30) Priority Data:

98/9866	29 October 1998 (29.10.98)	ZA
98/9867	29 October 1998 (29.10.98)	ZA
99/1831	8 March 1999 (08.03.99)	ZA

(71)(72) Applicant and Inventor: BRITS, Willem, Hendrik [ZA/ZA]; 29 Boekenhout Street, Dalpark, Extension 5, 1541 Brakpan (ZA).

(74) Agent: JOHN & KERNICK; Kernick House, Howick Close, Waterfall Park, 1685 Midrand (ZA).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

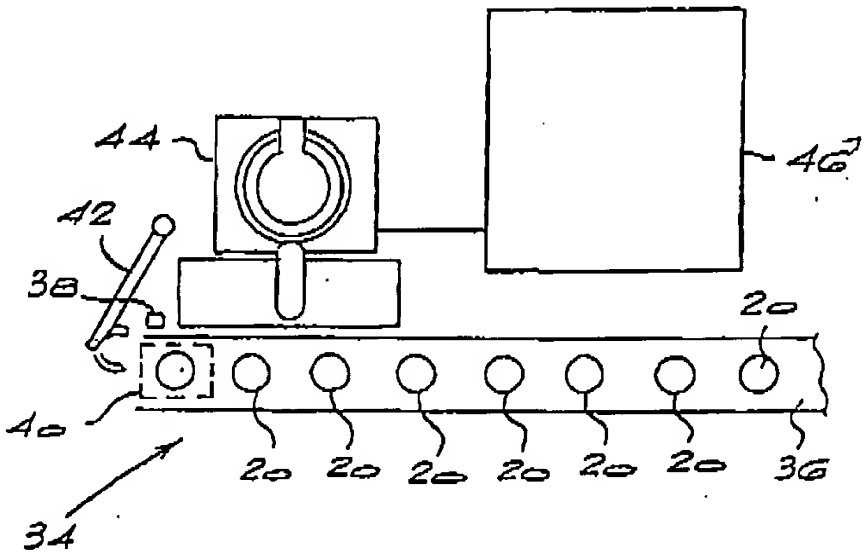
Published

Without international search report and to be republished upon receipt of that report.

(54) Title: ASSAYING

(57) Abstract

This invention relates to a method for assaying an ore sample to determine the concentration of gold and PGMs therein. The method comprises the steps of preparing an ore sample, combining the prepared ore sample with a lead–containing flux, inductively heating the combination (typically at a predetermined reference temperature profile) to form a fusion of slag and lead containing the gold and PGM's in the sample and separating the lead from the slag. The invention also covers a new flux for the process, the flux containing sodium hydroxide, a container for mixing the flux and an ore sample and an apparatus for separating molten lead from slag.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		

CLAIMS

1. A method for assaying an ore sample to determine the concentration of selected metals therein, comprising the steps of:

combining a prepared ore sample with a lead-containing flux;

inductively heating the combination to form a fusion of slag and lead containing the metals in the sample; and

separating the lead from the slag.

2. The method according to claim 1 wherein the combination is heated at a predetermined temperature profile.

3. The method according to claim 2 wherein the predetermined reference temperature profile is determined by the characteristics and amount of the ore sample and/or the flux.

4. The method according to claim 3 wherein the sample is supplied with a high level of heat for a predetermined first period of time and then supplied with a lower level of heat for a predetermined second period of time to form the fusion of slag and lead.

5. The method according to any one of the preceding claims wherein the sample of ore and flux are combined in a container made from carbon-based material, and the container, the sample, and the flux are inductively heated.

6. The method according to claim 5 wherein the container is made from plastics material and comprises a lid which is arranged to close the container sealingly.

7. The method according to claim 5 or 6 wherein the container includes identification means for identifying the sample contained therein.

8. The method according to claim 7 wherein the identification means is a barcode.

9. A method according to any one of the preceding claims wherein the flux contains sodium hydroxide.

10. The method according to any one of the preceding claims wherein the sample is heated inductively within a graphite melting pot in an induction furnace.

11. The method according to any one of the preceding claims wherein the sample is heated inductively within a zirconium melting pot in an induction furnace.

12. The method according to any one of the preceding claims wherein molten lead separated from the slag is poured into a chilled mould, to provide a solid lead button.

13. A method according to claim 5 including the steps of storing information on each sample on a central database, providing each container into which the sample is poured with a unique identification means,

identifying each container before inserting it into the induction furnace, correlating the identity of the container and information on the central database, and applying a predetermined reference temperature profile to the sample, according to the information on the sample stored in the database.

14. A method according to claim 13 wherein the identification means is a bar code and the bar code is identified with a scanner.

15. A method according to any one of the preceding claims wherein each solid lead button is stamped with an identification code.

16. A receptacle for separating molten lead from slag, the receptacle comprising a base with a side wall extending from the base, the side wall defining a top opening into the receptacle, and the side wall having a collecting cavity, wherein the collecting cavity is sized to collect a predetermined amount of molten lead.

17. A receptacle according to claim 16 wherein the collecting cavity is located proximate the top opening of the receptacle.

18. A receptacle according to claim 16 or 17 wherein barrier means is provided between the collecting cavity and the opening of the receptacle, to trap molten lead in the collecting cavity.

19. A receptacle according to any one of claims 16 to 18 wherein the collecting cavity is formed within a removable plug which is attachable to the side wall of the receptacle.

20. A receptacle according to any one of claims 16 to 19 including a first spout located at the top opening, above the collecting cavity.

21. A receptacle according to claim 20 including a second spout located at the top opening, diametrically opposed to the first spout.

22. A receptacle according to any one of claims 16 to 21 wherein the receptacle is also a melting pot for an induction furnace.

23. A receptacle according to any one of claims 16 to 22 made from graphite or zirconium.

24. A method for separating molten lead from slag, in the receptacle of claim 16, the method including the steps of:

1. introducing a slag with a predetermined amount of molten lead therein into the receptacle;

2. rotating the receptacle in a first direction toward the collecting cavity so that the molten lead fills and is retained within the cavity, rotating the receptacle further so that the slag is discharged from the opening to the receptacle;

3. rotating the receptacle so that the molten lead flows out of the opening to the receptacle; and

4. collecting the lead discharged from the opening of the receptacle.

25. A method according to claim 24 wherein the receptacle is a melting pot surrounded by an electromagnetic coil and the electromagnetic coil is rotated together with the melting pot.

26. A flux composition for use in fire assaying of ore samples, the composition containing sodium hydroxide.

27. The composition of claim 26 comprising 20% to 60%, by weight, sodium hydroxide.

28. The composition of any one of claims 26 to 28 further comprising:

20% to 60%, by weight, lead oxide; and
20% to 60%, by weight, borax.

29. The composition of claim 27 comprising 20% to 50%, by weight sodium hydroxide, 25% to 40% lead oxide and 25% to 40% borax.

30. The composition of any one of claims 26 to 30 further including silver nitrate.

31. A sealed container, made from a carbon-based material, the container containing a charge of flux composition including sodium hydroxide, for use in the fire assay of a sample of ore.

32. A container according to claim 31 including a replaceable lid.

33. A container according to claim 31 or 32 made from a combustible material.

34. A container according to claim 33 made from a plastics material.

35. A container according to claim 34 made from a mixture of plastics material and a flux material.

36. A container according to claim 35 wherein the flux material is calcium carbonate.

37. A container according to claim 36, the mixture including 60 to 80%, by weight, calcium carbonate.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P 14505PC00		
International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/IB99/01747	29/10/1999	29/10/1998
International Patent Classification (IPC) or national classification and IPC G01N33/20		
Applicant BRITS, Willem, Hendrik et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29/05/2000	12.04.2001
Name and mailing address of the international preliminary examining authority:	Authorized officer

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01747

I. Basis of the report

1. With regard to the elements of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-26 as originally filed

Claims, No.:

1-37 as received on 07/03/2001 with letter of 07/03/2001

Drawings, sheets:

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in th international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01747

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

☐ restricted the claims.

☒ paid additional fees.

☐ paid additional fees under protest.

☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☒ not complied with for the following reasons:
see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supp rting such statement

1. Statement

Novelty (N)	Yes:	Claims
	N :	Claims 1-37
Inventive step (IS)	Yes:	Claims
	No:	Claims 1-37

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/01747

Industrial applicability (IA)	Yes:	Claims	1-37
	No:	Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

INTERNATIONAL PRELIMINARY EXAMINATION REPORT - SEPARATE SHEET International applicati n No. PCT/IB99/01747

SECTION IV: UNITY

The claimed subject-matter does not comply with the requirement of unity of invention (Rules 13.1, 13.2 and 13.3 PCT).

The terms **"for use in a method for assaying an ore sample according to"** within the wording of claims 16-23 (device) and claims 26-37 (product) **do not constitute "special technical features"** in the sense of Rule 13.2 PCT (see in particular lines 4-6 of Rule 13.2 PCT) since they merely indicate that the device or product can be used for a particular purpose (not excuding any othe method or use). **The cited terms cannot, therefore, be considered as the basis for a single general inventive concept.**

The following groups of inventions are present in the international application:

1. first group: claims 1-15 (method for assaying ores containing the steps cited).
2. second group: claims 16-23 (receptacle).
3. third group: claims 24-25 (method for separating molten lead from slag)
4. fourth group: claims 26-30 (flux composition).
5. fifth group: claims 31-37 (a sealed container).

SECTION V:

The subject-matter of the first to fifth groups of inventions does not meet the novelty requirements of Article 33(2) PCT:

V.1 In this regard the attention of the applicant is drawn to the fact that terms like "for assaying an ore sample to determine the concentration of selected metals therein" in the wording of claim 1 does not add to the claimed process any step different from those explicitly cited in the claim namely combining ore and flux, heating (inductively) to fusion of slag and lead and separating lead from slag.

D1=US-A-5 849 649 discloses (see col. 1, line 18 and col. 2, lines 41-49 as well as col. 5, lines 31-35) a glass flux composition containing aluminium oxides, magnesium oxides, zirconium oxide and other oxides of metals, which can be considered ores since th y also naturally occur as minerals, and lead oxide mixed together. This is a glass flux composition to be used as enamel for application to ceramic ware. **Induction ovens being the most used type of ov n for glass production** and slags always separating from molten metals at the oven exit, it is therefore straightforward that a process such as that defined in D1 is prejudicial for the novelty of process claims 1 to15.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT - SEPARATE SHEET

International application No. PCT/IB99/01747

V.2 The terms " for use in fire assaying of ore samples" in the wording of claim 26 do not add to the claimed product anything over the composition explicitly disclosed. Nothing apart from the explicitly cited chemical compounds cited (namely sodium hydroxide) is present in the wording of the claimed product. Without citing any document, it is evident that claims 26 and 27 are not novel since it is evident that compositions containing exclusively sodium hydroxide or sodium hydroxide aqueous solutions containing amounts ranging from 20-60% by weight were known before the filing date of the present application.
In the absence of at least one differentiating technical feature present in the wording of the product independent claim, the novelty of the product claims 26 to 30 cannot be acknowledged.

V.3 The disclosure of document D2= WO-A-96/41161 (see figure 1) clearly concerns a receptacle with a collecting cavity (40,42) and a spout(18). Of course the walls of the collecting cavity act as a barrier between the collecting cavity and the opening of the receptacle. The cited document is prejudicial for the novelty of at least claims 16 to 25.
In the same way D3=GB-A-2 289 758 (see figure 3, items 18,22,20 and page 3, line 10-page 4, line 8) is also prejudicial for the novelty of at least claims 16 to 25.
V.4 The disclosure of D4=US-A-3 751 965 (see figures 1 to 3, in particular items 2, 5a and 1 as well as corresponding parts of the description) is prejudicial for the novelty of claims 31-37.

V.5 INVENTIVE STEP

None of the technical features of the dependent claims of all the groups of inventions (see use of carbon based plastic container identified by a bar code of claims 6 to 8 and its identification via a scanner of claims 14-15; graphite or zirconium melting pots of claims 10-11) nor any other technical feature disclosed in the description seems to solve a technical problem which could not have been solved by the normal procedures of the prior art. On the contrary they seem to concern merely well known features therefrom and therefore cannot be consid red inventive.

In the absence of at least one differentiating technical feature present in the wording of the process and product claims, which is responsible for the solution of a technical problem which could not have been solved by the technical features of the prior art (D1 to D4), the inventive step of the claimed subject matter according to Article 33(3) PCT cannot be acknowledged since differentiating technical features not solving a technical problem can be considered as obvious modifications of the prior art.

SECTION VIII:

The presence of two independent process (method) claims each of them concerning completely different technical features (claim 1 concerns the addition of a flux composition containing any amount of lead whereas claim 24 concerns the separation of a slag using a receptacle with a cavity and a product claim 26 concerning flux compositions comprising exclusively sodium hydroxide and two device claims (claim 16 concerns a receptacle with collecting cavity and claim 31 concerns a sealed container) does not allow third parties to know which of the technical features are essential for the invention to be performed and which other are merely optional features. Therefore, the claimed subject-matter of claims 1, 24 and 26 and that of claims 16 and 31 are in breach with the clarity requirements of Article 6 PCT.

All the independent process, product and device claims should concern exactly the same technical features. Failure to meet that request the clarity of the claimed subject-matter cannot be acknowledged (Article 6 PCT).

PCT REQUEST W/B/104

Original (for SUBMISSION) - printed on 29.10.1999 12:52:00 PM

0 0-1	For receiving Office use only International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.84 (updated 01.07.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	International Bureau of the World Intellectual Property Organization (RO/IB)
0-7	Applicant's or agent's file reference	W/B/104
I	Title of Invention	ASSAYING
II II-1 II-2 II-4 II-5	Applicant This person is: Applicant for Name (LAST, First) Address:	applicant and inventor all designated States BRITS, Willem, Hendrik 29 Boekenhout Street Dalpark Extension 5 1541 BRAKPAN South Africa
II-6	State of nationality	ZA
II-7	State of residence	ZA
II-8	Telephone No.	+27-11-915-3147
II-9	Facsimile No.	+27-11-915-3147
II-10	e-mail	lconnect@iafrica.com

PCT REQUEST W/B/104

Original (for SUBMISSION) - printed on 29.10.1999 12:52:00 PM

IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name (LAST, First)	GILSON, David, Grant
IV-1-2	Address:	Spoor and Fisher (Rochester Place 173 Rivonia Road Morningside Sandton) PO Box 41312 2024 Craighall South Africa
IV-1-3	Telephone No.	+2711-884-4701
IV-1-4	Facsimile No.	+2711-884-4499
IV-1-5	e-mail	info.jhb@spoor.co.za
IV-2	**Additional agent(s)**	additional agent(s) with same address as first named agent
IV-2-1	Name(s)	HOOPER, Anthony, Robert, Lloyd; DYER, Alison, Margaret; BROWN, Keith, Edwin, Frank; DE VILLIERS, Christopher, Murray; DOWER, John, Christopher; MOUBRAY, Hugh, Robert; TRIBE, Gillian, May; BLEWETT, Piers, Anthony; BULL, Christopher, Michael; KEMP, Mark; WHITTAKER, Jonathan, Denis; COCHRANE, David, Hylton
V	**Designation of States**	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

PCT REQUEST W/B/104

Original (for SUBMISSION) - printed on 29.10.1999 12:52:00 PM

V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
V-3	National Patent (States which have become party to the PCT after the issuance of this version of EASY)	MA
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	29 October 1998 (29.10.1998)
VI-1-2	Number	98/9866
VI-1-3	Country	ZA
VI-2	Priority claim of earlier national application	
VI-2-1	Filing date	29 October 1998 (29.10.1998)
VI-2-2	Number	98/9867
VI-2-3	Country	ZA
VI-3	Priority claim of earlier national application	
VI-3-1	Filing date	08 March 1999 (08.03.1999)
VI-3-2	Number	99/1831
VI-3-3	Country	ZA
VII-1	International Searching Authority Chosen	European Patent Office (EPO) (ISA/EP)

VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	26	-
VIII-3	Claims	6	-
VIII-4	Abstract	1	wb104_abstract.txt
VIII-5	Drawings	4	-
VIII-7	TOTAL	41	

PCT REQUEST W/B/104

Original (for SUBMISSION) - printed on 29.10.1999 12:52:00 PM

	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	Figure of the drawings which should accompany the abstract	3	
VIII-19	Language of filing of the international application	English	
IX-1	Signature of applicant or agent		
IX-1-1	Name (LAST, First)	GILSON, David, Grant	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/EP
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	